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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/079,925	02/20/2002	Vito Raineri	00CT17653333	6492

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EXAMINER	
PERT, EVAN T	
ART UNIT	PAPER NUMBER
2829	

DATE MAILED: 09/09/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/079,925	RAINERI ET AL.	
	Examiner	Art Unit	
	Evan Pert	2829	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 February 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *7-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *12-15,17-23,25 and 26* is/are allowed.

6)☒ Claim(s) *7-11,16 and 24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *20 February 2002* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *0603* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Drawings

1. The drawings are objected to because Fig. 13 is seemingly incomplete. Per page 6, line 10, opening 4A should be labeled and a metal layer 10 should be shown in electrical contact with layer 8.

2. The drawings are objected because Fig. 21 does not show units of time (e.g. "minutes").

3. The drawings are confusing at first reading because numeral 4 represents a layer having two thicknesses spaced laterally, while numerals 5 and 6 refer to different portions of the same layer 4. The examiner recommends revising the drawings to clearly indicate the nature of numerals 4, 5 and 6. However, revision of the drawings, with respect to clarification of numerals 4, 5 and 6, is not required, and is only recommended for additional clarity.

Claim Objections

4. Claim 7 is objected to because "a silicon carbide layer" should read --the silicon carbide layer-- (clearly referring to the SiC layer recited in the preamble). Appropriate correction is required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 10, 16 and 24 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The use of the term "heavy ions" is confusing since this term is often used in nuclear physics for high atomic number isotopes. What ions are included as "heavy ions" in this invention?

Applicant gives a single example of a "conventional 1% fluorine technique" using "silicon ions," but fails to set forth any detail about other appropriate ions to use. Where would one of ordinary skill in the art be able to ascertain the appropriate "heavy ions" to practice the claimed invention?

For purposes of examination, any "ions" that can cause lattice damage when implanted in SiC are considered as being within the scope of applicant's "heavy ions."

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 7, 9, 10 and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Eshita (EP 0 363 944).

Regarding claim 7, Eshita discloses a method for forming isolating structures (25) in a silicon carbide layer (top portion layer of SiC 21), the method comprising: forming a masking layer on first and second portions of a silicon carbide layer (22 is what is left after removing to expose the first portions); forming openings through the masking layer to expose the first portions of the silicon carbide layer (i.e. form the openings in mask 22 over regions 23 wherein regions 23 correspond to the claimed "first portions"); implanting ions into the first portions of the silicon carbide layer (p. 4, lines 17-19); and heating the silicon carbide layer to form an oxide layer thereon having first portions on the first portions of the silicon carbide layer and having second portions on the second portions of the silicon carbide layer, with the first portions of the oxide layer having a first thickness and the second portions of the oxide layer having second thickness less than the first thickness (seen as 1st portions 25 and 2nd portions 24 in Fig. 2b).

Regarding claim 9, Eshita discloses that the photoresist mask 22 is removed before heating the SiC layer (p. 4, lines 20-25)

Regarding claim 10, since any "ion" that can cause defects when implanted in SiC are considered as "heavy ions" in view of the rejection under 35 USC 112 above, Eshita discloses B, P and As ions, which are "ions" that cause damage when implanted in SiC such that oxidation rates are affected.

Regarding claim 11, the ions disclosed by Eshita are "dopants" because they are electrically active in SiC semiconductor.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Eshita as applied to claim 7 above, and further in view of "EP 0 845 803 A1" in combination with Wolf (1990 textbook).

Eshita does not disclose or teach "removing the oxide layer" to form isolating regions at the first portions and "depositing insulation material" in the isolating regions to form isolating structures.

The '803 document discloses that removal of oxide formed by oxidizing implanted regions of SiC results in a trench with clean sidewall (col. 7-8, line 22).

Wolf discloses that "trench etch and refill" technology is suitable for "isolating devices of the same type, and hence they can be considered as replacements for LOCOS isolation." [2.6.1]

It would have been obvious to one of ordinary skill in the art at the time of the claimed invention to modify the invention of Eshita by adopting "trench etch and refill" known to the ordinary of skill at the time of filing the instant case (see Wolf text). One of ordinary skill in the art would be motivated, by the teachings of the '803 document and Wolf, to adopt well known "trench etch and refill" as a replacement for the LOCOS type isolation taught by Eshita:

The '803 document discloses that removal of the oxide (e.g. transition from Fig. 2C to Fig. 2D) results in "clean" trench walls, which would motivate one of ordinary skill in the art to adopt the '803 document's removal of oxide to form a trench. One of ordinary skill would be motivated to fill with "insulation material" because insulation material impedes electric current, which is desired for "isolation" as is notoriously well known for the fill material of isolation trenches.

Allowable Subject Matter

8. Claims 16 and 24 would be allowable if rewritten to overcome the rejections under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

9. Claims 12-15, 17-23 and 25-26 are allowed.

10. The following is a statement of reasons for the indication of allowable subject matter: The prior art does not disclose or fairly suggest applicant's method for isolating an epitaxially grown silicon carbide diode, particularly characterized by removing an oxide layer formed by oxidation of implanted SiC to have a thickness at first portions greater than a thickness at a second portion wherein the isolating trenches of the epitaxially grown diode are formed by removal of oxide at the first portions.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Baliga (U.S. 5,270,244) is cited for teaching forming an oxide filled isolating trench in silicon carbide by oxidizing implanted regions.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Evan Pert whose telephone number is 703-306-5689. The examiner can normally be reached on M-F (7:30AM-3:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamand Cuneo can be reached on 703-308-1233. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 308-0956.

ETP
September 3, 2003

EVAN PERT
PRIMARY EXAMINER